comparison with the total obstruction of light while others show large diminution of light with only a slight amount of reddening.

When the dust storm of May 10 covered a large section of the Middle West one could see the sun shining faintly through the dust cloud and to the eye the color of the sun appeared to be bluer than normal. Professor Struve suggested that I try to obtain an accurate measure of the color of the sun through the cloud with the photo-electric photometer, in order to test whether this apparent departure from the laws of light scattering was real.

The photo-electric photometer of the Yerkes Observatory has been described by Dr. Joel Stebbins.[2] It contains a sensitized potassium photo-electric cell and for measuring colors a pair of filters is used which, when combined with the sensitivity-curve of the cell, give effective wave-lengths of 4250 A for the blue filter and 4750 A for the yellow one. In order to make observations on the sun without damage to the photo-electric cell the 12-inch telescope on which the photometer is attached was diaphragmed to an aperture of 3 inches for observing the sun through the dust cloud and to ¼ inch when the sun was at normal brightness. For further decreasing the intensity of the light falling on the cell it was necessary to place near the focussed image of the sun an aperture of 2 mm which allowed only a small area of the disk of the sun to fall on the cell. Immediately following the aperture was a "flashed" opal diffusing screen. The potential on the cell was reduced from the usual 176 volts to 19½ volts. Precautions were taken that no light could leak into the photometer.

The observations for color were made in the usual manner, measuring the brightness of the sun through the filters: first, once through the yellow one, then twice through the blue, twice through the yellow, twice through the blue and finally once more through the yellow filter, thus giving four readings through each filter. The relative brightnesses are then expressed in stellar magnitudes which give a measure of the color of the object. Since we are interested in a change in the color of the sun from the normal it is necessary to observe it at exactly the same altitude on a day when the sky is free from dust and clouds. This occurred 5 days later. In the meantime the photometer was left unchanged so as to introduce as few variables as possible into the comparison.

Two sets of observations were taken each on May 10 and on May 15, the date for comparison. The observed color of the sun through the dust cloud was $+0.83 \pm 0.03$ (average deviation) magnitudes. On May 15, when the transparency of the sky was judged as excellent for photometric purposes, the color of the sun was $+0.89 \pm 0.01$ magnitudes. The sense of the sign is such that larger positive numbers represent redder colors. Thus, it is seen that, if there is any change at all, it is in the direction of the sun being bluer as seen through the dust cloud. However, considering the difficulties involved and also considering the average deviations I would say that there had been no change in color. The difference is nearly equal to the sum of the average deviations. We can then conclude that there was an insufficient amount of dust fine enough to produce Rayleigh scattering even though the brightness of the sun was reduced to less than one percent [3] of its normal brightness. All of the dust particles must be larger than a few microns in diameter. This is perhaps what might have been expected since the dust was more or less of local origin, being picked up by the high winds over the drought stricken areas of the Great Plains. A sample of the dust falling here was collected by Dr. Keenan and an examination with a microscope showed that most of the particles averaged about 0.1 mm. in diameter.

The apparently decided blue color of the sun as seen visually through the dust cloud is merely an effect of contrast. One ordinarily sees the sun projected against a blue sky and of course the sun is yellower than the sky. The dust cloud had a brownish color and consequently the sun by contrast appeared bluer than normal.

[2] Astrophysical Journal, *74*, 289, 1931.

[3] This is determined from a comparison of the observations of the two days, taking into account the areas of the apertures admitting light to the telescope objective. The accurate comparison shows that the brightness of the sun as seen through the dust cloud at 9:43 a.m. C.S.T. on May 10 was 0.8 of 1 percent as bright as on May 15 at the same zenith distance.

THE TROPICAL DISTURBANCE OF JUNE 5–23

By G. E. DUNN

[Weather Bureau, Washington, Aug. 6, 1934]

The early history of this storm remains rather obscure. Disturbed conditions were noted in the Gulf of Honduras on the 4th and, as the depression had deepened and some movement was apparent, advices were issued the morning of the 5th, the day it crossed the coastline of British Honduras near Belize, where a maximum wind of 34 miles from the northwest was recorded. During that afternoon and night it apparently turned to the southwestward or south. On the morning of the 6th Tapachula, on the coast of Mexico, near the Guatemalan border, reported a barometer reading of 29.6 inches and a 24-hour fall of 0.18 inches. On June 7 the following message was received from the Pan American Airways station at San Salvador, Salvador:

> A severe storm struck this place early this morning with torrential rain and winds in excess of 50 miles per hour. Present wind south 30 miles per hour. Considerable damage reported due to heavy rain.

Press reports indicate that between 1,000 and 3,000 persons were killed or injured in Honduras, perhaps due to floods in the majority of cases. The town of Ocotepeque in western Honduras suffered greatly, with more than 500 people killed. Only the church remained standing after the flood. The rainfall, according to some reports, was in excess of 25 inches at a number of places. Great destruction and suffering occurred in both Salvador and Honduras.

Because of the extreme paucity of reports from this area considerable conjecture is necessary, but the disturbance may have moved southwestward or southward from British Honduras to the Guatemalan or Salvadorean coast, intensified along their Pacific coasts, and recurved inland again over Salvador, crossed Honduras and passed northward into the Gulf of Honduras where it was definitely located on the 8th. During its passage over this Gulf it apparently regained hurricane intensity once more and then passed inland over the extreme northern portion of British Honduras in the late afternoon of the 8th. On the 9th it crossed the Yucatan peninsula and moved into the Gulf of Mexico. The Mexican Meteorological Service reported that winds of hurricane force occurred over a portion of the peninsula.

During the next 2 days this disturbance continued to move northwestward, but on the 12th made a complete

loop in the southwestern Gulf of Mexico and then began to move slowly north-northeastward. On the afternoon of the 15th the first vessel report from the vicinity of the center was received, the S.S. *Belfast Maru*, about 240 miles south of the Louisiana coast, reporting a wind velocity of 70 miles from the south-southeast and a barometer reading of 28.76 inches. The following warning was immediately issued:

Hoist northeast storm warnings 4 p.m. Pensacola, Fla., to Morgan City, La. Tropical disturbance central 1 p.m. about 26° N. and 96° 40 minutes W. moving slowly north-northeastward attended by shifting gales and probably by winds of hurricane force near center. Caution advised vessels in path. Present indications are that center will reach eastern Louisiana coastline Saturday afternoon or night.

Hurricane warnings were ordered the next morning between Grand Isle and Vermilion Bay, La. As the storm approached the Louisiana coast, its rate of movement increased and Dr. I. M. Cline, of the Weather Bureau at New Orleans, reports that between Jeanerette and Baton Rouge, La., it traveled about 27 miles per hour—an unusually rapid rate. It crossed the coastline a short distance west of Morgan City, which reported a barometer reading of 28.9 inches and a wind velocity of 68 miles from the southeast at 2 p.m. The center passed over Jeanerette, Iberia Parish, where a calm and a barometer reading of 28.58 inches occurred from 2 p.m. to 2:45 p.m. The center passed slightly to the west of Baton Rouge about 4:10 p.m. with a barometer reading there of 28.8 inches. Six persons in Louisiana were killed and damage to property amounted to about $2,605,000.

The storm, slowly decreasing in intensity, moved northeastward during the next few days, giving needed rainfall to the North and Middle Atlantic States, and passed over central Maryland on the 19th. A maximum wind velocity of 50 miles per hour was recorded at Atlantic City, N.J. It passed beyond the field of observation over northern Greenland on the 23d.

BIBLIOGRAPHY

C. FITZHUGH TALMAN, *in charge of Library*

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Anderson, Abram E.

Sand fulgurites from Nebraska. Their structure and formative factors. 1925. p. 49–86. illus. 22½ cm. (Nebraska state museum. Bulletin 7, v. 1, June 1925.)

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SOLAR OBSERVATIONS

SOLAR AND SKY RADIATION MEASUREMENTS DURING JUNE 1934

By IRVING F. HAND, *Assistant in Solar Radiation Investigations*

For a description of instruments employed and their exposures, the reader is referred to the January 1932 REVIEW, page 26.

Table 1 shows that solar radiation intensities averaged above normal for June at Madison and close to normal at Washington and Lincoln.

Beginning with this issue, summaries of the total radiation (direct + diffuse) received on a horizontal surface at the University of Washington Oceanographic Laboratory, Friday Harbor, Washigton (latitude 48° 32′ N., longitude 123° 01′ W.; height above sea level 4.37 meters), will be regularly included in table 2 through the kind cooperation of Dr. C. L. Utterback. The radiation equipment at that station comprises an Eppley pyrheliometer (no. 262) recording on an Engelhard microammeter (no. 30737). Table 2–A gives the radiation values from this station for the International Polar Year, July 30, 1932, to August 19, 1933, inclusive.

Table 2 shows an excess in the total solar radiation received on a horizontal surface at all stations with the exception of Pittsburgh and Miami.

Beginning with this month, *air mass* types will be indicated with screened radiation measurements, as shown in the last column of table 3.

Polarization measurements made on 4 days at Washington give a mean of 56 percent with a maximum of 57 percent on the 28th. At Madison, measurements made on 7 days give a mean of 65 percent with a maximum of 70 percent on the 21st. The values for Washington are slightly below normal for June, while those at Madison are above normal.